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SHORT REPORT

The Use of an Extra-corporeal Graft to Maintain Cerebral Perfusion During Thoracic Endovascular Aneurysm Repair

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Endovascular access for aneurysm repair can be challenging in patients with iliofemoral occlusive disease. The carotid artery is an alternative access site, but may increase the risk of cerebral hypoperfusion during stent delivery. We describe a novel approach, where temporary extra-corporeal bypass was used to maintain cerebral perfusion during endovascular thoracic aneurysm repair via the carotid artery, in a patient with significant aorto-iliac and arch vessel disease.

Keywords: Extra-corporeal graft; Cerebral perfusion; Endovascular access; Thoracic aneurysm repair.

Introduction

As endovascular techniques for aneurysm repair continue to evolve, increasingly complex cases are being considered for intervention. However, access-related problems can still preclude stent delivery, despite aneurysm morphology suitable for endovascular repair. We describe a novel approach, where a temporary extra-corporeal bypass was used to maintain cerebral perfusion and subsequent thoracic stent delivery performed via the carotid artery, in a patient with significant aorto-iliac and arch vessel disease.

Report

A 62-year-old female presented with a large asymptomatic thoracic aneurysm and a smaller abdominal aortic aneurysm. Comorbidity included ischaemic heart disease, chronic obstructive airways disease, hypertension and hypercholesterolaemia. Dobutamine stress echo demonstrated good left ventricular function with no inducible ischaemia, but lung function tests were severely limited, with a FeV1 of 0.96L (46%).

Aortic CT demonstrated aneurysms of the descending thoracic (Fig. 1A) and infra-renal aorta, measuring 68 mm and 48 mm respectively. The external iliac arteries were narrow (6 mm) and diseased, but the common iliac arteries appeared to be of adequate calibre (8 mm) for stent delivery, although heavily calcified (Fig. 1B). An attempt was made to gain access for stent delivery via the left common iliac artery using a conduit, but this approach was abandoned, as heavy circumferential calcified plaque extended proximally to the aortic bifurcation, preventing adequate proximal control and safe conduit anastomosis.

To assess the suitability of the arch vessels for stent delivery, a pre-operative arch arteriogram was performed. This demonstrated a tight right internal carotid artery stenosis, left subclavian artery occlusion and retrograde flow in the left vertebral, confirmed by duplex imaging. The anatomy of the left common carotid artery (8 mm) appeared favourable for stent delivery, but endovascular access via this route was limited by the risk of cerebral hypoperfusion.

To maintain peri-operative cerebral perfusion, a right-axillary-to-left-common-carotid extra-corporeal bypass graft was performed using a 8 mm Dacron

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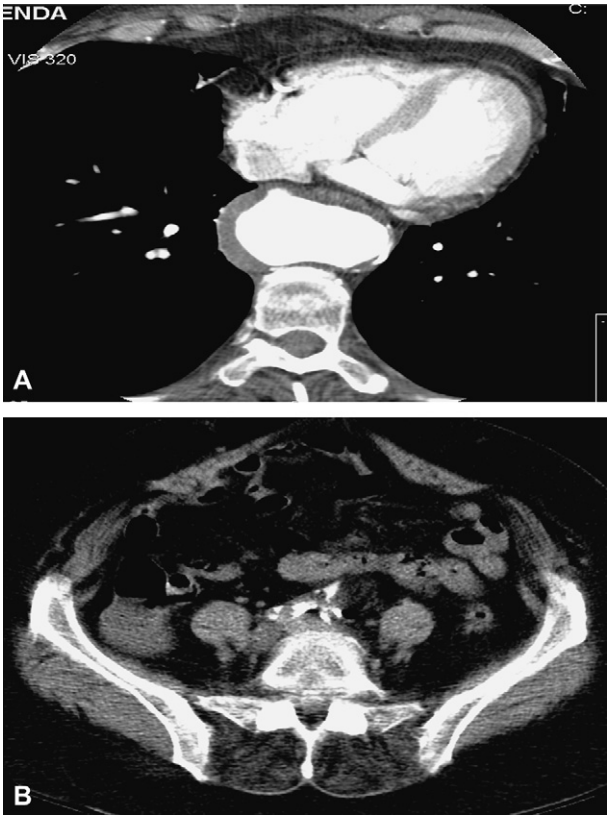

Fig. 1. A. Thoracic aneurysm of descending aorta. B. Calcified iliac vessels.

graft with end-to-side anastomoses. Flow in the left middle cerebral artery was damped on clamping the left common carotid artery, confirmed by transcranial Doppler monitoring. A Valiant 38 mm endovascular graft (24F sheath) was delivered proximally via the left common carotid artery, clamped below the bypass (Fig. 2A). The stent was deployed in a satisfactory position (Fig. 2B) and the temporary bypass was then removed, with patch closure of the carotid artery. The patient was neurologically intact postoperatively, made an uneventful recovery and was fit for discharge on the sixth post-operative day.

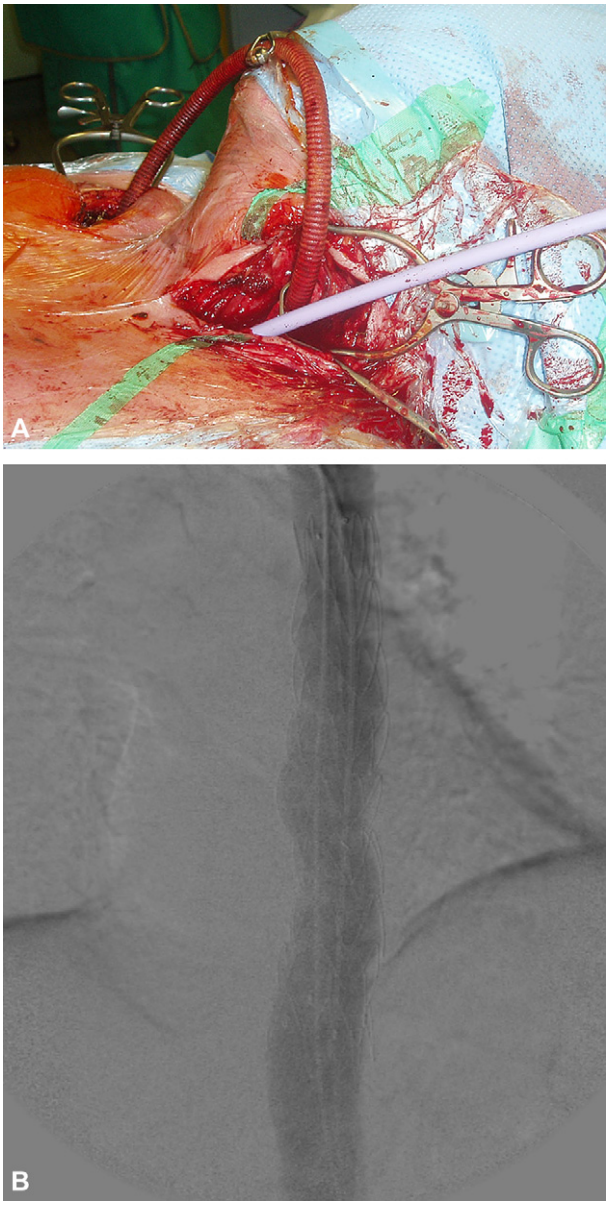

Fig. 2. A. Stent graft delivery through proximal left common carotid artery with extra-corporeal bypass graft. B. Completion angiogram following endovascular repair of thoracic aneurysm.

Discussion

Endovascular aneurysm repair relies upon successful stent-graft delivery via remote arterial access sites. Due to severe aorto-iliac disease, access through the lower extremities was impossible for this patient. Direct aortic access was also considered, combining repair of the small infra-renal aneurysm with a side-branch conduit for stent delivery. However the risks of direct aortic access were considered too great, in a patient with significant co-morbidity and severely limited lung function. By using the left carotid artery alone for potential access, the risks of peri-operative cerebral ischaemia were high, in the context of a significant asymptomatic contra-lateral carotid artery stenosis, left subclavian occlusion and retrograde flow in the ipsilateral vertebral artery. A common-carotid-to-common-carotid bypass was considered as an initial option to maintain cerebral perfusion of the left carotid system, but was discounted because of the

potential for steal from the diseased right internal carotid artery. The right axillary artery was therefore chosen to provide in-flow for the extra-corporeal bypass. Trans-cranial Doppler monitoring was used to ensure cerebral perfusion was maintained throughout the procedure.

Although access through the common carotid artery for repair of thoracic and abdominal aortic aneurysms has previously been described,[1,2] the use of extra-corporeal bypass to maintain cerebral perfusion is a novel approach, with previous authors relying on back-bleeding and stump pressures as a guide to adequate cerebral perfusion.[1–3]

Temporary extra-corporeal carotid bypass should be considered to increase access options for endovascular aneurysm repair in those patients unsuitable for ilio-femoral access and at risk from peri-operative cerebral ischaemia.

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